Software Publishers

(NAICS 5112)

SIGNIFICANT POINTS

- Employment is projected to increase 68 percent between 2002 and 2012, ranking software publishers as the fastest growing industry in the economy.
- Computer specialists account for half of all workers in this industry.
- Job opportunities will be excellent for most workers; professional workers enjoy the best prospects, reflecting continuing demand for higher level skills needed to keep up with changes in technology.

Nature of the Industry

All organizations today rely on computer and information technology to conduct business and operate more efficiently. Computer software is needed to operate and protect computer systems and networks. Some 8,200 establishments are engaged primarily in computer software publishing or publishing and reproduction. Software publishing establishments carry out operations necessary for producing and distributing computer software, such as designing, providing documentation, assisting in installation, and providing support services to software purchasers. These establishments may design, develop, and publish, or publish only. Establishments providing access to software for clients from a central host site, designing custom software to meet the needs of specific users, or involved in mass duplication of software are classified elsewhere. (For more information, see the statement on computer systems design and related services found elsewhere in the *Career Guide*.)

Software publishing establishments that design and publish prepackaged software may develop operating system software as well as word processing and spreadsheet packages, games and graphics packages, data storage software, and Internet-related software tools such as search engines and Web browsers—the software that permits browsing, retrieval, and viewing of content from the Internet. Some establishments may install the software package on a user's system and provide customer support.

Software is often divided into two main categories—applications software and systems software. Applications software includes individual programs for computer users—such as programs for word processing or for developing and maintaining spreadsheets and databases. Systems software, on the other hand, includes the operating system and all of the related programs that enable the computer to function. The Internet has vastly altered the complexion of the software industry over the last decade. Much applications and system software is developed for use on the Internet and for connections to the Internet.

Organizations are constantly seeking to implement technologies which will improve efficiency. Enterprise resource planning (ERP) software is such an example. ERP consists of cross-industry applications that automate a firm's business processes. Common applications include human resources, manufacturing, and financial management software. Examples of more recent applications are software to manage customer relations and a firm's sources of supply, known as customer relationship management (CRM) and supply-chain management software. Enterprise resource planning software has traditionally been implemented by large organizations with vast computer networks.

Electronic business (e-business) is any process that a business organization conducts over a computer network. Electronic commerce (e-commerce) is that part of e-business that involves the buying and selling of goods and services. With the growth of the Internet and the expansion of e-commerce, there is significant demand for e-commerce software that enables businesses to become as efficient as possible.

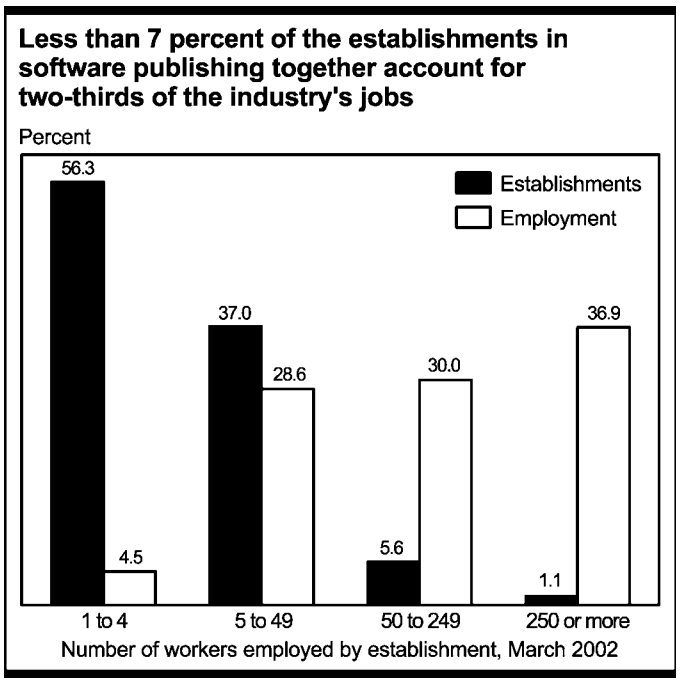
This widespread use of the Internet and Intranets also has led to greater focus on the need for computer security. The robust growth of e-commerce increases this concern, as firms seek to attract as many potential customers as possible to their Web sites. Security threats range from damaging computer viruses to online credit card fraud. As a result, organizations and individual computer users are demanding software that secures their computer networks or individual computer environments. Examples of such software are firewalls and antivirus software.

Working Conditions

Most workers in this industry work in clean, quiet offices. Given the technology available today, however, more work can be done from remote locations using modems, fax machines, e-mail, and especially the Internet.

About 9 percent of the workers in software publishing firms work part time, compared with 16 percent of workers throughout all industries. For some professionals, evening or weekend work may be necessary to meet deadlines or solve problems. Professionals working for large establishments may have less freedom in planning their schedule than do consultants for very small firms, whose work may be more varied.

Employees who work at video terminals for extended periods may experience musculoskeletal strain, eye problems, stress, or repetitive motion illnesses, such as carpal tunnel syndrome.



Employment

In 2002, there were about 256,000 wage and salary jobs in the industry. While the industry has both large and small firms, the average establishment in software publishing is relatively small; over half of the establishments employed fewer than 5 workers. About two-thirds of jobs, however, are found in a small number of establishments that employ 50 or more workers (chart 1). Many small establishments in the industry are startup firms that hope to capitalize on a market niche.

Relative to the rest of the economy, there are significantly fewer workers 45 years of age and older in software publishing establishments; this industry's workforce remains younger than most, with large proportions of workers in the 25-to-44 age range (table 1). This reflects the industry's explosive growth in employment since the early 1980s. The huge increase in employment afforded numerous opportunities to younger workers possessing the latest technical skills.

Occupations in the Industry

Providing a wide array of information services to clients requires a diverse and well-educated workforce. The majority of workers in the software publishing industry are professional and related workers, such as computer software engineers and computer programmers (table 2). This occupational group accounts for nearly 60 percent of the jobs in the industry, reflecting the emphasis on high-level technical skills and creativity. By 2012, the employment share of professional and related occupations is expected to be even greater, while the employment share of office and administrative support jobs, currently accounting for 12 percent of industry employment, is projected to fall.

Table 1. Percent distribution of employment, by age group, 2002

Age group	Software publishers	All industries
Total	100.0%	100.0%
16-19	0	4.8
20-24	5.8	9.9
25-34	43.0	21.6
35-44	34.6	26.3
45-54	15.7	22.9
55-64	1.0	11.4
65 and older	0	3.2

Programmers write, test, and maintain the detailed instructions, called programs or software, that computers must follow to perform their functions. These programs tell the computer what to do—which information to identify and access, how to process it, and what equipment to use. Programmers write these commands by breaking down each operation into a logical sequence of steps, converting the instructions for those steps into a language that the computer understands. While some still work with traditional programming languages like COBOL, object-oriented programming languages such as C++ and Java, computer-aided software engineering (CASE) tools, and artificial intelligence tools now are being used to create and maintain programs. These languages and tools allow portions of code to be reused in programs that require similar routines. Many programmers also customize purchased software or create better software to meet a client's specific needs.

Computer software engineers design, develop, test, and evaluate software programs and systems. Although programmers write and support programs in new languages, much of the design and development now is the responsibility of *software engineers* or *software developers*. Software engineers must possess strong programming skills, but are more concerned with developing algorithms and analyzing and solving programming problems than with actually writing code. These professionals develop many types of software, including operating systems software, network distribution software, and a variety of applications software. *Computer systems software engineers* coordinate the construction and maintenance of a company's computer systems, and plan their future growth. They develop software systems for control and automation in manufacturing, business, and other areas. They research, design, and test operating system software, compilers—software that converts programs for faster processing—and network distribution software. *Computer applications software engineers* analyze users' needs and design, create, and modify general computer applications software or specialized utility programs. They analyze user needs and develop software solutions. Video game programmers are software engineers who plan and write video game software.

Computer support specialists provide technical assistance, support, and advice to customers and users. This group of occupations includes workers with a variety of titles, such as *technical support specialists* and *help-desk technicians*. These troubleshooters interpret problems and provide technical support for software and systems. Support specialists may work either within a company or other organization or directly for a computer software vendor. They answer telephone calls, analyze problems using automated diagnostic programs, and resolve difficulties encountered by users.

Other computer specialists include a wide range of professionals who specialize in operation, analysis, education, application, or design for a particular piece of the system. Many are involved in the design, testing, and evaluation of network systems such as local area networks (LAN), wide area networks (WAN), the Internet, and other data communications systems. Specialty occupations reflect an emphasis on client-server applications and end-user support; however, occupational titles shift rapidly to reflect new developments in technology.

A growing number of marketing and sales workers also are employed in this industry. In order to compete successfully and gain customers and clients in the online world, the presentation and features of software and other content related to information technology becomes increasingly important. For example, publishers of software that provides connections to the Internet must be able to differentiate their products from those of their competitors. Marketing and sales workers are responsible for promoting and selling the products and services produced by the industry.

Table 2. Employment of wage and salary workers in software publishing industry by occupation, 2002 and projected change, 2002-12
(Employment in thousands)

Occupation	Employment, 2002 Number	Employment, 2002 Percent	Percent change, 2002-12
All occupations	256	100.0	67.9
Management, business, and financial occupations	48	18.9	71.6
Top executives	7	2.8	64.4
Marketing managers	3	1.3	67.9
Sales managers	3	1.2	82.1
Computer and information systems managers	9	3.3	81.9
Financial managers	2	0.9	68.0
Engineering managers	2	0.9	68.0
Management analysts	4	1.4	68.0
All other business operations specialists	3	1.3	83.3
Accountants and auditors	3	1.3	67.2
Professional and related occupations	150	58.7	73.8
Computer programmers	22	8.5	43.3
Computer software engineers, applications	41	15.8	82.9
Computer software engineers, systems software	18	7.2	91.0
Computer support specialists	21	8.0	68.0
Database administrators	2	0.8	92.4
Computer systems analysts	9	3.5	81.2
Network and computer systems administrators	5	1.8	81.2
Network systems and data communications analysts	3	1.2	105.9
All other computer specialists	6	2.5	82.5
Market research analysts	4	1.4	69.7
Multimedia artists and animators	3	1.1	68.0
Technical writers	3	1.3	68.0
Sales and related occupations	22	8.8	50.6
Sales representatives, wholesale and manufacturing, technical and scientific products	7	2.9	34.4
Sales representatives, wholesale and manufacturing, except technical and scientific products	3	1.2	68.0
Sales engineers	3	1.1	68.0
Telemarketers	3	1.3	25.6
All other sales and related workers	3	1.3	68.0
Office and administrative support occupations	32	12.4	47.2
Bookkeeping, accounting, and auditing clerks	2	0.9	43.3
Customer service representatives	7	2.7	68.0
Secretaries and administrative assistants	7	2.7	41.1
Office clerks, general	3	1.0	46.3

NOTE: May not add to totals due to omission of occupations with small employment.

Training and Advancement

Occupations in the software publishing industry require varying levels of education. The level of education and type of training required depend on the employer's needs. One factor affecting these needs is changes in technology. As demonstrated by the current demand for workers with skills related to the Internet and computer security, employers often scramble to find workers capable of implementing "hot" new technologies. Another factor driving employers' needs is the timeframe within which a project must be completed.

Computer programmers commonly hold a bachelor's degree; however, there are no universal educational requirements. Some hold a degree in computer science, mathematics, or information systems, while others have taken special courses in computer programming to supplement their study in fields such as accounting, inventory control, or other areas of business. Because employers' needs are so varied, a 2-year degree or certificate may be sufficient for some positions so long as applicants possess the right technical skills.

Most computer software engineers have at least a bachelor's degree and broad knowledge and experience with computer systems and technologies. Usual degree concentrations for applications software engineers are computer science or software engineering; for systems software engineers, usual concentrations are computer science or computer information systems. Graduate degrees are preferred for some of the more complex software engineering jobs.

Persons interested in becoming a computer support specialist generally need only an associate degree in a computer-related field, as well as significant hands-on experience with computers. They also must possess strong problem-solving and analytical skills as well as excellent communication skills because troubleshooting and helping others are such vital parts of the job. And because there is constant interaction on the job with other computer personnel, customers, or employees, computer support specialists must be able to communicate effectively on paper, using e-mail, or in person. They also must possess strong writing skills when preparing manuals for employees and customers. As technology continues to improve, computer support specialists must constantly strive to stay up to date and acquire new skills if they wish to remain in the field.

The size of the firm and the local demand for workers also may influence training requirements for specific jobs. Smaller

firms may be willing to train informally on the job, whereas larger organizations may pay for formal training or higher education. For example, many marketing and sales workers are able to secure entry-level jobs with little technical knowledge but quickly acquire knowledge of their company's products and services through on-the-job training. With more formal education, employees may advance to completely different jobs within the industry. Education or training in a specialty area, such as information security, may provide new opportunities for the worker and allow the establishment to offer new services.

Continuing technological advances in the computer field have led to demand for workers with a higher level of skill and expertise. Employers, hardware and software vendors, colleges and universities, private training institutions, and professional computing societies offer continuing education and professional development seminars. The Institute of Electrical and Electronics Engineers Computer Society, for example, recently created a certification process for software development professionals who possess a bachelor's degree and work experience that demonstrates a body of knowledge, and who pass a written examination.

Software publishing offers advancement opportunities for all workers who keep up with changing technology. For example, computer support specialists may move into computer programmer positions and, later, into computer software engineer jobs. This advancement usually results from work experience and continued training and education.

Entry-level computer programmers usually start working with an experienced programmer to update existing code, generate lines of one portion of a larger program, or write relatively simple programs. They then advance to more difficult programming and may become project supervisors, or move into higher management positions within the organization. Many programmers who work closely with systems analysts advance to systems analyst positions.

Computer software engineers who show leadership ability also can become project managers or advance into management positions, such as manager of information systems or even chief information officer. Technical support specialists may advance by developing expertise in a particular program or software that can lead to opportunities as a programmer or software engineer.

Many experienced workers also have opportunities to move into sales positions as they gain knowledge of specific products and services. Computer programmers who write accounting software, for example, may use their specialized knowledge to sell such products to similar firms. Also, computer support specialists providing technical support for an operating system may eventually market that product, based on their experience and knowledge of the system.

Earnings

Employees in the software publishing industry generally command higher earnings than the national average. All production or nonsupervisory workers in the industry averaged $1,258 a week in 2002, significantly higher than the average of $506 for all industries. This reflects the concentration of professionals and specialists who often are highly compensated for their skills or expertise. Given the pace at which technology advances in this industry, earnings can be driven by demand for specific skills or experience. Earnings in selected occupations in software publishing appear in table 3.

Table 3. Median hourly earnings of the largest occupations in software publishing, 2002

Occupation	Software publishers	All industries
General and operations managers	$58.02	$32.80
Computer and information systems managers	48.85	40.98
Computer software engineers, systems software	37.08	35.60
Computer software engineers, applications	36.75	34.09
Sales representatives, wholesale and manufacturing, technical and scientific products	34.60	26.80
Computer programmers	32.15	28.98
Computer specialists, all other	31.80	26.00
Computer systems analysts	31.38	30.24
Computer support specialists	20.61	18.80
Executive secretaries and administrative assistants	18.37	16.06
Customer service representatives	14.77	12.62

As one might expect, education and experience influence earnings as well. For example, annual earnings of computer software engineers ranged from less than $47,160 for the lowest 10 percent to more than $114,630 for the highest 10 percent in 2002. Managers usually earn more because they have been on the job longer and are more experienced than their staffs, but their salaries, too, can vary by level and experience. Accordingly, annual earnings of computer and information systems managers ranged from less than $62,380 for the lowest 10 percent to more than $145,600 for the highest 10 percent in 2002. Earnings also may be affected by size, location, and type of establishment, hours and responsibilities of the employee, and level of sales.

Outlook

Employment in the software publishing industry has more than doubled over the past decade, 1992-2002. Despite the recent economic downturn among firms involved in information technology, software publishing is, nevertheless, projected to be the fastest growing industry in the U.S. economy over the next decade. Wage and salary employment is expected to increase by 68 percent between 2002 and 2012, more than four times the 16 percent growth projected for all industries combined. Even in difficult economic times, organizations continue to make investments in software. Software boosts productivity, increases efficiency, and, in some cases, reduces the need for workers. Growth will not be as rapid as it was during the previous decade, however, as the software industry begins to mature and as routine work is increasingly outsourced overseas.

An increasing reliance on information technology, combined with falling prices of computers and related hardware, means that individuals and organizations will continue to invest in applications and systems software to maximize the return on their investments in equipment and to fulfill their growing computing needs. Such needs include the expansion of electronic commerce,

a growing reliance on the Internet, faster and more efficient and secure internal and external communication, and the development of new technologies and applications. Given the rate at which the software publishing industry is expected to grow, and the increasing integration and application of software in all sectors of the economy, job opportunities should be excellent for most workers. Professional workers should enjoy the best opportunities, reflecting employers' continuing demand for higher level skills to keep up with changes in technology. However, employment growth may be tempered somewhat as companies contract out more of the routine tasks to foreign countries, where labor costs are lower, in an attempt to remain competitive.

Today, there is demand for software products ranging from Web browsers, home networking software, and firewalls to maintain security to video games and other entertainment-related software products. Yet, new growth areas will continue to arise from rapidly evolving technologies and business forces. The increasing uses of the Internet, the proliferation of websites, and mobile technology such as the wireless Internet have created demand for a wide variety of new software. The market for educational software and entertainment software, which includes video games, is also expected to experience robust growth over the next decade.

The way the Internet is used is constantly changing, and so is the software required to run the new and emerging computer applications. Expanding electronic commerce, for example, has changed the way companies transact business. Business-to-business commerce is automating many steps in the transaction of business between companies, allowing many firms to operate more efficiently. Businesses are moving their supply networks online and participating in and developing online marketplaces. The sustained growth of electronic commerce as well as the growing uses of intranets and extranets will drive demand for increasingly sophisticated software tools geared towards these technologies. And, as the amount of electronic information stored and accessed continues to grow, new applications and security needs will increase demand for database software. Demand for an even wider array of software applications also should increase as companies continue to expand their capabilities, integrate new technologies, and develop new applications.

One significant factor contributing to growth in software is computer security. Organizations invest heavily in software to protect their information and secure their systems from attack. And, as more individuals and organizations are conducting business electronically, the importance of maintaining computer system and network security will increase, leading to greater demand for security software.

Given the increasingly widespread use of information technologies and the overall rate of growth expected for the software publishing industry, most occupations should grow very rapidly, although some faster than others. The most rapid job increases will occur among computer specialists such as computer software engineers, as firms continue to install sophisticated computer networks, set up Internet and intranet sites, and engage in electronic commerce, and as consumers continue to explore and use vast amounts of applications software.

Sources of Additional Information

Further information about computer careers is available from:

- Association for Computing Machinery (ACM), 1515 Broadway, New York, NY 10036.
  Internet: **http://www.acm.org**

- Institute Electrical and Electronics Engineers Computer Society, Headquarters Office, 1730 Massachusetts Ave. NW., Washington, DC 20036-1992.
  Internet: **http://www.computer.org**

- National Workforce Center for Emerging Technologies, 3000 Landerholm Circle SE., Bellevue, WA 98007.
  Internet: **http://www.nwcet.org**

Information on the following occupations can be found in the 2004-05 *Occupational Outlook Handbook*:

- Computer and information systems managers
- Computer programmers
- Computer software engineers
- Computer support specialists and systems administrators
- Computer systems analysts, database administrators, and computer scientists